

BYERS PIPE

**GENUINE WROUGHT IRON
FULL WEIGHT GUARANTEED**

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The Installation Cost of Pipe

IT is apparent that where the cost of any given material used in construction is but a fraction of the incidental cost of installation or replacement, the question of durability is of the greatest consequence. In a large proportion of power, hydraulic, plumbing, heating, and other installations, it is conceded that the life of the whole system is limited largely by the ability of the pipe material to resist corrosive attack. In such installations the superior lasting quality of well-made, genuine wrought iron as a pipe material is generally recognized, leaving the question of the extra cost of such pipe to be considered *in its relation to the installation and replacement cost of the whole system*, rather than by a mere comparison of the first cost of one kind of pipe with that of another.

The itemized cost analyses of pipe systems contained herein, are dedicated to engineers, architects, and builders, in the hope that they will aid in clarifying the premises upon which so many important decisions are made.

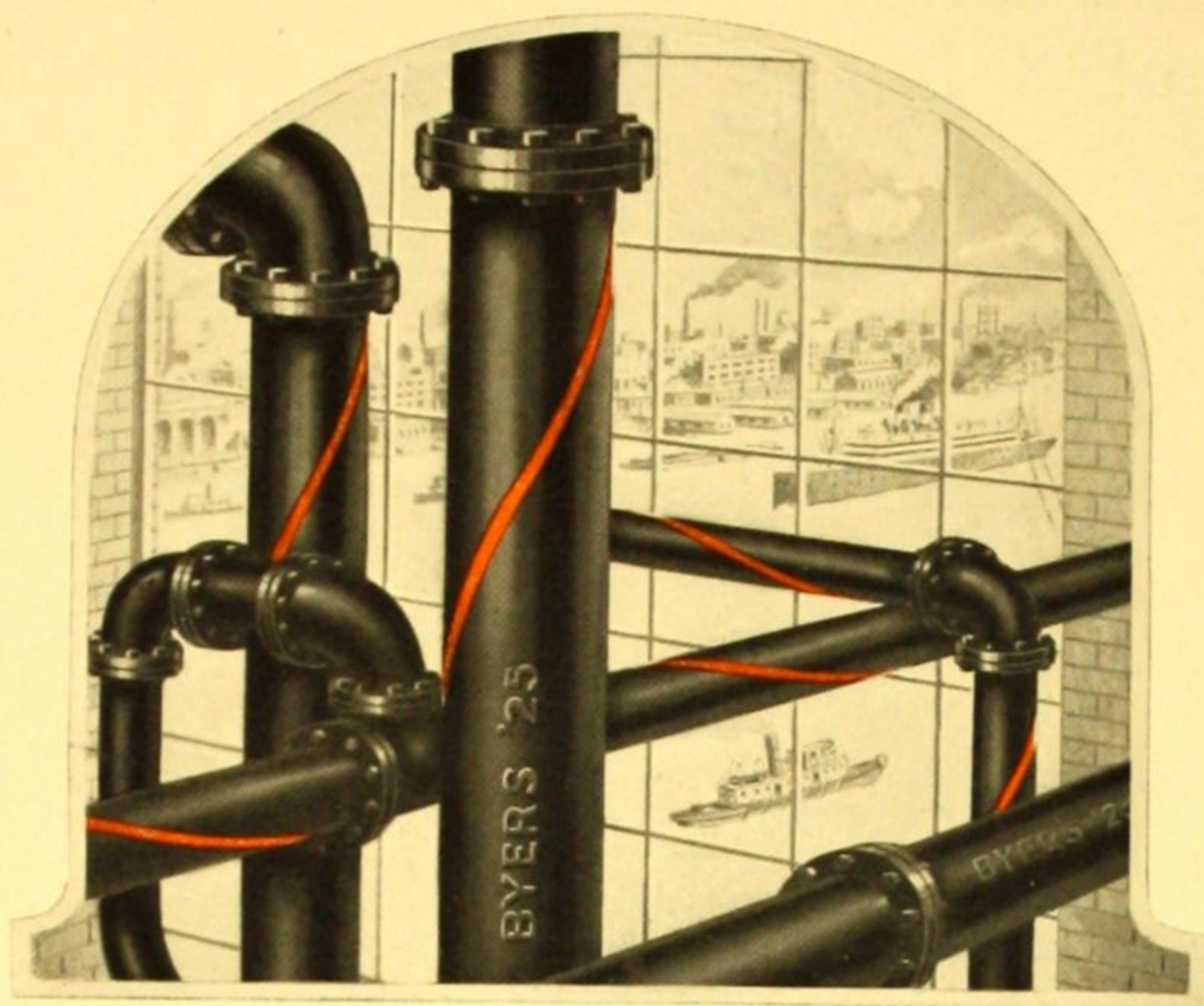
Pittsburgh, September, 1925.

A. M. BYERS COMPANY

Relation of Installation Cost to the Pipe Cost and Life in Service of 33 Iron and Steel Pipe Installations



THE above diagram illustrates the relative proportions obtained by averaging and reducing to a percentage basis, the figures for installation cost of pipe systems, as shown in cost analyses of 33 different pipe systems, on Pages 8 to 29 herein. The area of crescent No. 4, represents the average extra life of the whole pipe system which results from adding to the installation cost (area 1 and area 2) the small extra cost of Byers pipe represented by area 3.



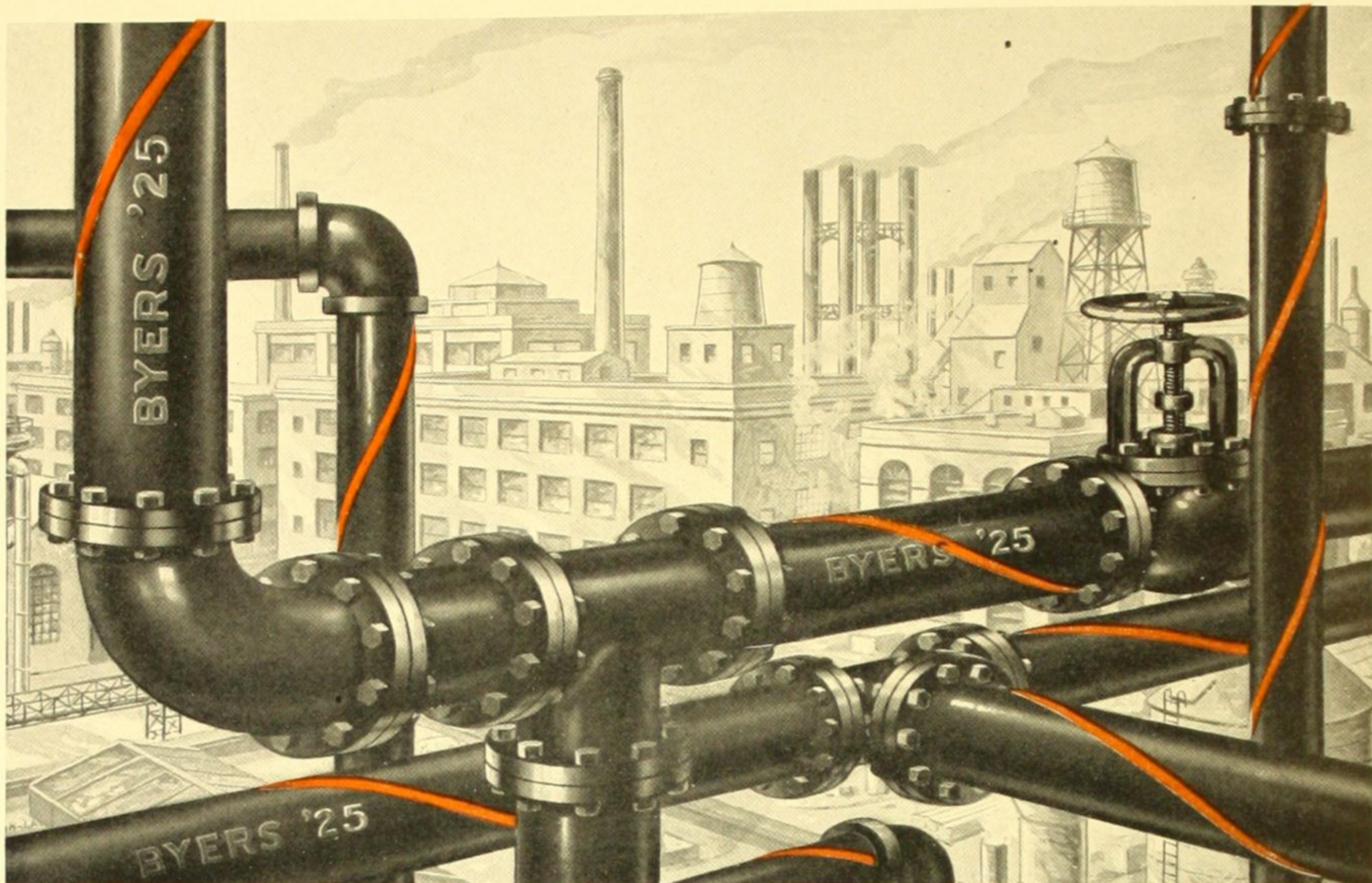
The Extra Cost of Byers Pipe

Dialogue between a General Manager and his Chief Engineer

“THE extra cost of Byers pipe on this job is \$641.02,” said the general manager in looking over the estimate for a drinking water system. “That’s 75% more than for the other pipe.” “Let’s see,” retorted the chief engineer. “This pipe system, including the fountains, will cost \$7406.71 if steel pipe is used. Eighty-four per cent of this cost is for fittings, valves, shop labor, covering, overhead, and supervision. Using Byers pipe adds only 7.9% to this bid; making it \$8047.73. If Byers pipe gives double life in service, this additional \$641.02 purchases as much value as the first \$7400.”

“How do you make that out?” asked the general manager.

“It’s like this,” said the chief engineer. “When the pipe rusts out, as it gradually will, you have to replace the whole system, piecemeal or all at once, for you cannot remove the pipe without dismantling the whole system. Now, there is little or no salvage on such an item as pipe covering, and as for valves and fittings, you could not afford to put them into a new system even if most of them did not have damaged threads. The items of freight, shop labor, installation, overhead, and supervision and contractor’s profit are entirely lost. In fact, the shop



and labor costs in making replacements are doubled or trebled, for the replacements usually have to be made piecemeal, with the least possible interference with mill operation. It's a pretty well established fact that Byers genuine wrought iron pipe lasts two or three times longer than cheaper pipe; so, you see, the \$641.02 extra is well worth while."

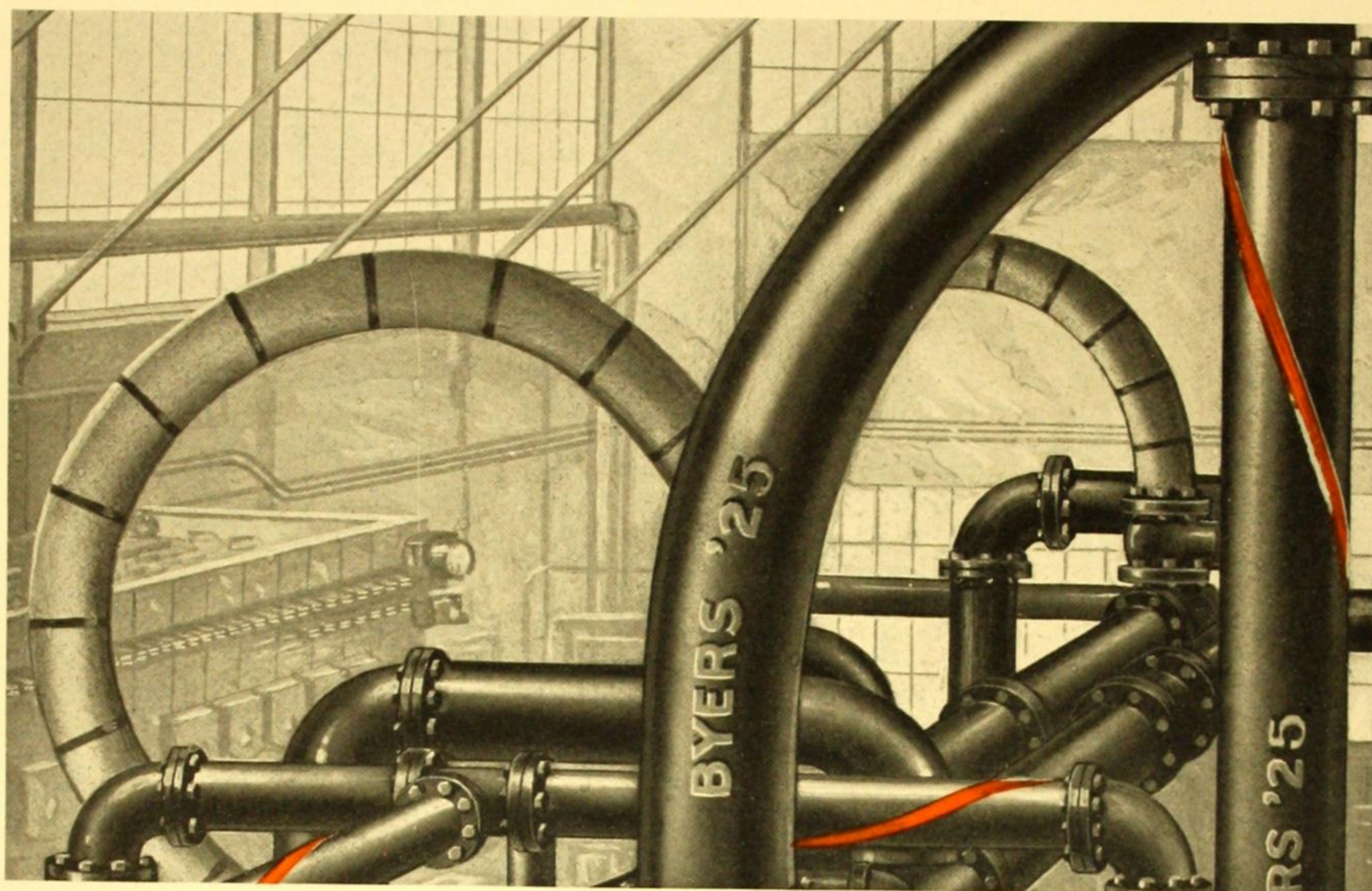
The general manager, after a moment's thought, came back at his very capable looking engineer with the most obvious rejoinder.

"But suppose the pipe lasts longer than the fittings, valves and covering?"

"The covering can easily be replaced without disturbing the system. Valves and fittings have two or three times the thickness of the pipe, so naturally the pipe is shorter lived, as far as corrosion is concerned, and you only have to figure with an occasional replacement of a worn out or leaky valve or fitting."

"But, this must be an exceptional case in that the pipe item is very insignificant and the other items in the installation very high," said the general manager.

"You would naturally think so," was the reply, "but I have had a lot

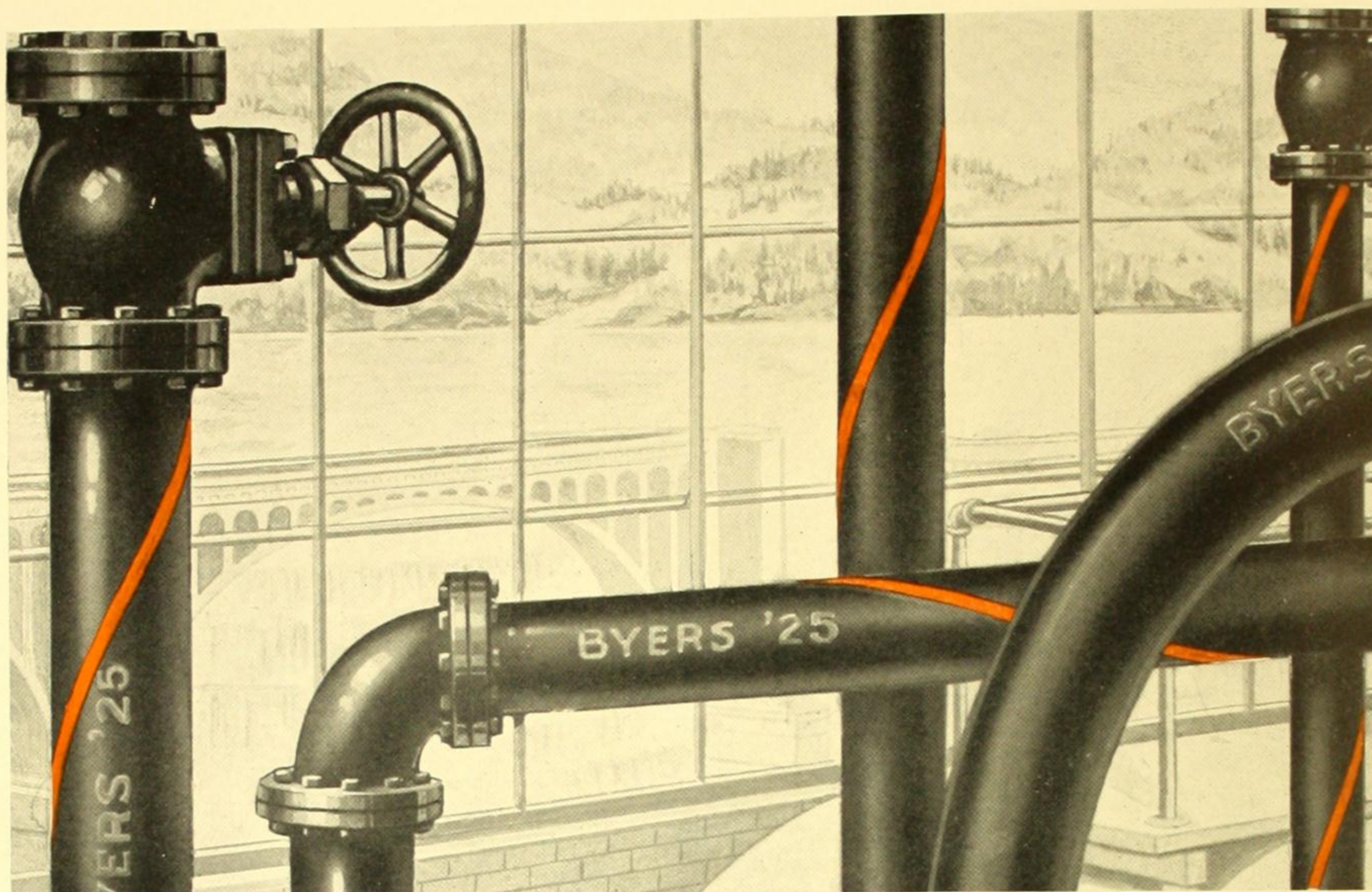


of experience in this line while with the Halden & Banks Piping Company, you know. From my experience with them I know this is not an exceptional case, for the item of pipe alone in the average pipe system is only a small fraction of the total cost."

"What do you mean by an average pipe system?", interrupted the general manager.

"It makes little difference whether you are dealing with plumbing, heating, power or industrial pipe systems. Take, for instance, the piping system for our new boiler water treating plant. Or take the complete power piping for the new city water works which was installed by Halden & Banks; or the hydraulic piping they installed for the Burbank Mills; or any of the dozens of heating or water supply systems they have installed in various places. In any of these systems, I am sure the pipe item alone could not have amounted to more than ten to fifteen percent, and the difference between so-called 'wrought pipe' and genuine wrought iron pipe would then be about 5% of the total installation cost."

"What do you mean by the total installation cost? Do you include

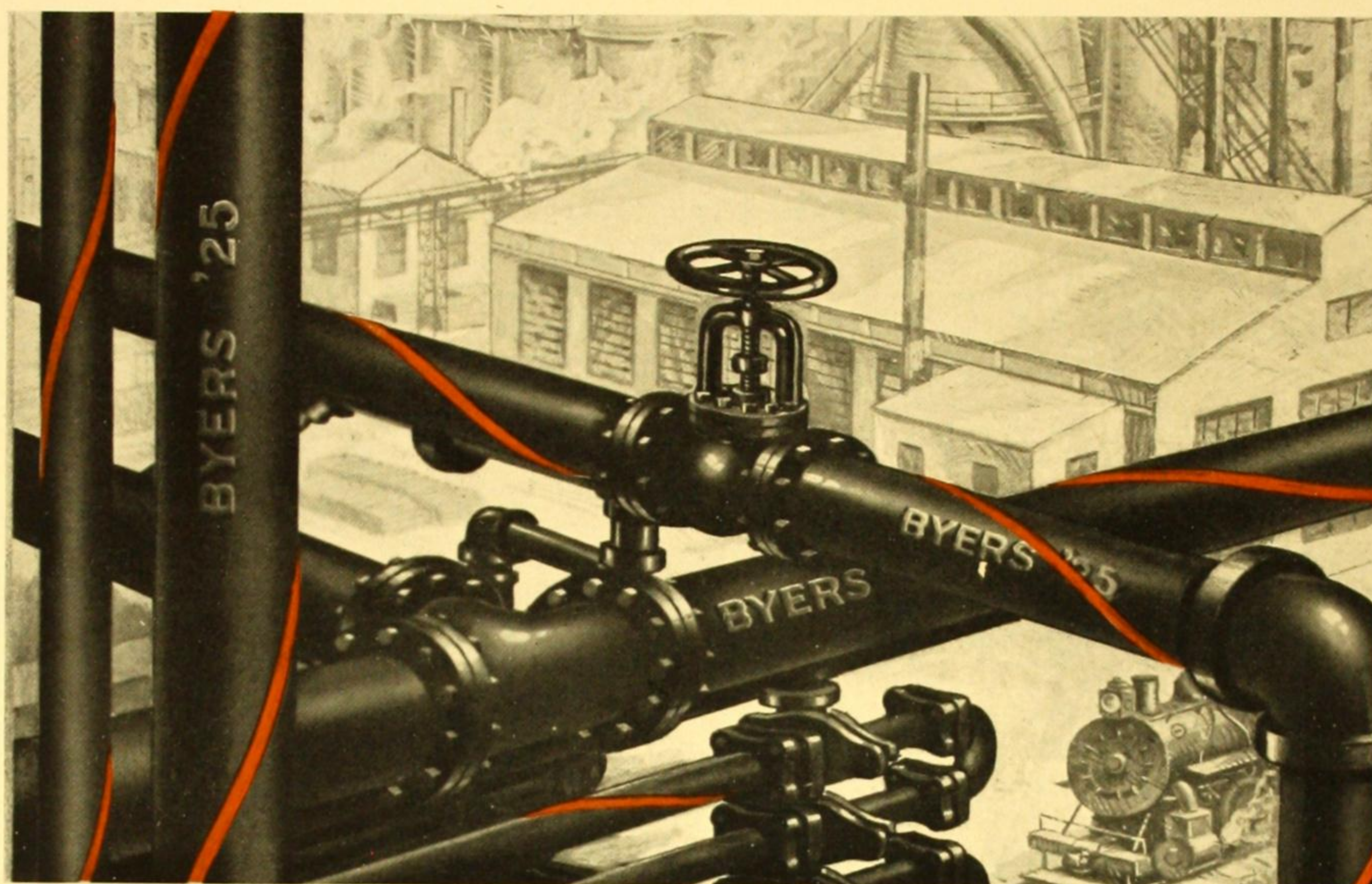


therein engines, boilers, pumps, fans, compressors, and other mechanical equipment used in the system?"

"Not at all, sir. Excepting plumbing and heating installations, I am speaking only of the pipe system in itself, stripped of everything but its integral parts, such as valves, fittings, hangers, supports, covering, and the like."

"That is rather surprising. I always imagined the pipe was at least half the cost," said the general manager. "I certainly would like to see some more figures; for if you are quite right (which I do not doubt), it puts this whole matter of pipe in an entirely different light. You know the Byers representative wants us to standardize on Byers pipe."

"Yes, I do," retorted the chief, "and I feel it would be a good thing for us, but before recommending any action, I will speak to the master mechanic and I will also have my assistant analyze the old cost sheets we have here and some estimates I will get from Halden & Banks, making recapitulations of each estimate, showing the main items of cost. And, while I am at it, I will also have him prepare replacement



cost estimates for the same jobs, to show what expense is involved in making repairs or rebuilding a system in case the pipe rusts out.”

“How about the incidental cost of interrupted operations?”, asked the general manager.

“That, of course, is too big and too variable a factor to be estimated, except in specific cases,” responded the chief.

“I certainly would be interested in seeing the figures,” said the general manager. “How soon can you have them finished?”

“In a couple of weeks; you know there are hundreds of items in a piping estimate, and we have to analyze and classify each item carefully in order to arrive at the correct totals, leaving out all items which are not affected by a failure of the pipe.”

P. S. The estimates as they were laid before the general manager a couple of weeks later, are reproduced, with comments and explanations, on the following pages.

These estimates cover actual jobs, and include a large variety of installations, thus representing a fair average for pipe systems generally, including plumbing and heating.

Hydraulic Pipe System

Water and Steam Piping for Hydraulic Presses in Three Separate Buildings

Installation Cost

Pipe only (Byers)	\$1,211.65
Valves and Fittings	8,320.45
Flanges, Bolts, Gaskets, Hangers, Supports	1,066.52
Shopwork and Erection Labor	8,647.50
Pipe Covering	1,675.00
Overhead and Supervision	1,750.00
Total, using Byers Pipe	\$22,671.12

Extra Cost of Byers Pipe

If steel pipe had been used, the above pipe system would have cost \$22,110.12.

Difference in cost of pipe only (including overhead and contractor's profit)	\$ 561.00
Percent "Saving" by using steel pipe	2.5%

Estimated Replacement Cost

First Cost, as above	\$22,671.12
100% extra labor	8,647.50
Repairs to foundations, floors, and mechanical equipment	1,000.00
	\$32,318.62

Less Salvage:

30% on valves and fittings	\$2,496.00
30% on flanges, hangers, etc.	320.00 2,816.00

NET REPLACEMENT COST	\$29,502.62
Percent extra cost of Byers Pipe over steel, based on replacement cost	1.9%

NOTE: It will be seen that if the pipe rusts out, the replacement cost may amount to even more than the total first cost of the entire system. The small initial saving of \$561.00 which might have been effected by using steel pipe in the above system, must therefore be compared with the greatly increased liability to pipe failures. Such failures would eventually involve the owner in a replacement cost of \$29,502.62. In other words, 2.5% extra cost of Byers Pipe would be a small premium, paid but once, to insure the whole system against premature destruction. Probable stoppage of plant operation, or idle time of employees during periods of repair and renewal, are not taken into consideration in the above estimated replacement figures. The extra labor involved is estimated at a minimum, while salvage and damage items are placed at a reasonable average.

In hydraulic pipe systems, rust resistance, accurate threads, tight joints and sound welds are absolutely essential. For some of the largest installations in the world, Byers Pipe has been installed solely by reason of its safety of weld, tightness of joint and ability indefinitely to withstand vibration, shocks and other physical stresses, without crystallization of the pipe metal.

Ammonia Condensers

Installation Cost

Pipe 2-inch Byers Lapweld	\$2,034.43
Ammonia Flange Unions and Gaskets.....	221.00
Channels and Bolts for Supports.....	100.00
Supervision, Overhead and Profit.....	828.63
Red Lead and Painting.....	180.00
Gas for Welding.....	250.00
Hauling.....	200.00
Labor, Cutting, Threading, Welding.....	709.75
Total, using Byers Pipe.....	\$4,523.81

Extra Cost of Byers Pipe

Difference between cost of 2-inch lapwelded wrought iron and steel pipe.....	\$845.43
Percent difference as compared with total cost.....	18.7%
Extra life of genuine wrought iron.....	137%

Cost Per Year of Service, or Actual Depreciation

Steel Condenser, cost \$3,678.38, average life 8 years, depreciation per year.....	\$459.80
Byers Wrought Iron Condenser, cost \$4,523.81, average life 19 years, depreciation per year.....	238.10

EXPLANATORY NOTE

The average life of steel pipe ammonia condensers, by careful investigation of service records in hundreds of the largest ice and refrigeration plants in New York, Boston, Washington, D. C., Pittsburgh, Cleveland, Cincinnati, Chicago, and Milwaukee, has been found to be 8 years, as against 19 years for genuine wrought iron. The "cost per year of service" in the above has been figured on this basis, and is equivalent to depreciation per year.

It will be seen that even though the initial cost of a condenser, if made of genuine wrought iron pipe, is from 15 to 20 percent more than the cost of a steel pipe condenser, the depreciation of the former is so much smaller that its ultimate cost is only about one-half that of a steel pipe condenser.

Power Piping for Cement Works

Steam Mains, Branches, Drips and Drains

Installation Cost

Pipe only (Byers)	\$4,564.23
Valves	3,410.00
Fittings, Flanges, Bolts, Gaskets, Hangers and Supports	3,386.24
Shop Work and Erection Labor	4,251.05
Overhead, Contractor's Profit and Miscellaneous	4,108.48
Total, using Byers Pipe	\$19,720.00

Extra Cost of Byers Pipe

If steel pipe had been used, the above steam system would have cost \$17,834.00	
Difference in cost of pipe only (including overhead and contractor's profit)	\$1,886.00
Percent "Saving" by using steel pipe	9.5%

Estimated Replacement Cost

Steam piping system as above	\$19,720.00
100% extra labor	4,251.05
Damage to walls, floors, partitions and mechanical equipment	1,500.00
	\$25,471.05

Less Salvage:

30% on valves	\$1,023.00
30% on fittings, flanges, etc.	1,015.87
	2,038.87

NET ESTIMATED REPLACEMENT COST	\$23,432.18
Percent extra cost of Byers Pipe over steel, based on replacement cost	8.0%

Under the contract system of arranging for pipe installations, all the owner ordinarily sees is the total cost of the work (which is frequently higher than was expected) and which quite naturally leads him to consider methods of reducing the outlay. One of the first items which comes to his mind is the pipe itself. But if, at the time of writing specifications or of purchasing pipe, every owner could have before him a condensed cost analysis, such as the above, there would be little question in his mind as to what kind of pipe to use.

NOTE: It will be seen that if the pipe rusts out, the replacement cost may amount to even more than the total first cost of the entire system. The small initial saving of \$1,886.00 which might have been effected by using steel pipe in the above system, must therefore be compared with the greatly increased liability to pipe failures. Such failures would eventually involve the owner in a replacement cost of \$23,432.18. In other words, the 9.5% extra cost of Byers Pipe would be the premium, paid but once, to insure the whole system against premature destruction. Probable loss of production, or idle time of workmen during periods of repair and renewal, are not taken into consideration in the above estimated replacement figures. The extra labor involved is estimated at a minimum, while salvage and damage items are placed at a reasonable average.

Power Piping in Chemical Plant

Steam Headers, Mains and Branches

Installation Cost

Pipe only (Byers)	\$ 5,298.00
Valves and Expansion Joints	17,718.30
Fittings, Flanges, Hangers, Supports, Bolts and Gaskets	4,917.95
Shopwork and Erection Labor	6,746.42
Overhead, Contractor's Profit and Miscellaneous	6,975.33
Total, using Byers Pipe	\$41,656.00

Extra Cost of Byers Pipe

If steel pipe had been used, the above system would have cost \$39,491.00.

Difference in cost of pipe only (including overhead and contractor's profit)	\$2,165.00
Percent "Saving" by using steel pipe	5.2%

Estimated Replacement Cost

Steam System as above	\$41,656.00
100% extra labor	6,746.42
Damage to walls, floors and mechanical equipment	2,000.00
	\$50,402.42

Less Salvage:

30% on valves	\$5,315.49
30% on fittings, flanges, etc.	1,475.38
	6,790.87

NET ESTIMATED REPLACEMENT COST	\$43,611.55
Percent extra cost of Byers Pipe over steel, based on replacement cost	5.0%

NOTE: It will be seen that if the pipe rusts out, the replacement cost will amount to even more than the total first cost of the entire system. The small initial saving of \$2,165.00 which might have been effected by using steel pipe in the above system, must therefore be compared with the greatly increased liability to pipe failures. In other words, the 5.2% extra cost of Byers Pipe would be a small premium, paid but once, to insure the whole system against premature destruction. Probable loss of revenue because of idle time, during periods of repair and renewal, is not taken into consideration in the above replacement figures. The extra labor involved is estimated at a minimum, while salvage and damage items are placed at a reasonable average.

The above is a fairly typical power plant installation, involving a very high expenditure for flanges, valves, fittings, hangers and labor, practically all of which represents a dead loss when the pipe fails. Especially for the smaller sizes of pipe, in which there is more or less condensation of steam, the danger of rapid corrosion is to be considered.

With the high standardization reached in power plant equipment, it seems reasonable to assume that obsolescence is ever becoming a smaller factor, and it is well to remember that even of installations made twenty or thirty years ago, there are still a great many in service.

Water Piping in Chemical Plant

All Lines Above Ground Except Intake to Pumps

Installation Cost

Pipe only (Byers)	\$500.93
Valves and Fittings	723.46
Flanges, Bolts, Gaskets, Hangers and Supports	418.18
Pipe Covering	750.25
Shopwork and Erection Labor	1,034.59
Freight, Overhead, Contractor's Profit and Miscellaneous	551.71
Total, using Byers Pipe	\$3,979.12

Extra Cost of Byers Pipe

If steel pipe had been used, the above piping system would have cost \$3,748.12.

Difference in cost of pipe only (including overhead and contractor's profit)	\$231.00
Percent "Saving" by using steel pipe	5.8%

Estimated Replacement Cost

First cost of system, as above	\$3,979.12
100% extra labor	1,034.59
Damage to walls, floors, tanks and pumps	250.00
	\$5,263.71

Less Salvage:

20% on valves and fittings	\$145.00
30% on hangers, flanges, etc.	125.00 270.00

NET ESTIMATED REPLACEMENT COST	\$4,993.71
Percent extra cost of Byers Pipe over steel, based on replacement cost	4.6%

Even among practical engineers and mechanical men, there are few who realize the consistently small extra cost of Byers Pipe in any pipe system, and the comparatively heavy penalty paid for pipe failures.

Pipe replacements, indeed, are so costly as to warrant an initial expenditure many times greater than the one shown, in order to obtain the longer life and greater freedom from repairs insured by the use of Byers genuine wrought iron pipe. Even if the cost of Byers Pipe were double what it actually is, it would in most cases be a good investment.

NOTE: It will be seen that if the pipe rusts out, the replacement cost may amount to even more than the total first cost of the entire system. The small initial saving of \$231.00 which might have been effected by using steel pipe in the above system, must therefore be compared with the greatly increased liability to pipe failures. Such failures would eventually involve the owner in a replacement cost of \$4,993.71. In other words, the 5.8% extra cost of Byers Pipe would be a small premium, paid but once, to insure the whole system against premature destruction. Probable stoppage of plant operation, and idle time of workmen during periods of repair and renewal, are not taken into consideration in the above. The extra labor involved is estimated at a minimum, while salvage and damage items are placed at a reasonable average.

Ten Industrial Pipe Systems

Steam, Water, Air, Gas, Oil Piping in Ten Separate Industrial Piping Installations

The ten industrial systems shown below include typical pipe installations for handling steam, water, air, gas, oil and condensates. Included are figures covering installations in paper mills, sugar factories, blast furnaces, rolling mills, glass works, and power plants of various types. These average figures were compiled by a firm of nationally known pipe fabricators for reference by their estimators, and represent modern practice both as regards design and installation of pipe systems in present day manufacturing establishments.

The average extra cost of Byers Pipe over steel pipe, as indicated by these ten systems, is 5.2%, while 4.7% is the average of nine separate industrial installations shown in this bulletin and made by other fabricators and contractors. The close agreement of these figures from independent sources emphasizes the small extra cost of Byers Pipe in practically all classes of industrial pipe systems.

Average Installation Cost

Pipe only (Byers)	\$4,800.00
Valves and Expansion Joints	5,600.00
Fittings, Flanges, Hangers, Supports, Bolts, Gaskets, and Cast Iron Pipe	9,600.00
Heat Insulating Material	2,000.00
Shop Work and Erection Labor	7,600.00
Freight, Overhead, Contractor's Profit and Special Items	10,400.00
	\$40,000.00

Extra Cost of Byers Pipe

If steel pipe had been used in the above installations the average cost would have been \$37,930.00.

Difference in cost of pipe only (including overhead and contractor's profit)	\$2,070.00
Percent "Saving" by using steel pipe	5.2%

Estimated Replacement Cost

System as above	\$40,000.00
100% extra labor	7,600.00
Damage to walls, partitions and mechanical equipment	2,000.00
	\$49,600.00

Less Salvage:

20% on valves and expansion joints	\$1,120.00
30% on fittings, flanges, etc.	2,880.00
Special items	1,000.00
	5,000.00

NET ESTIMATED REPLACEMENT COST	\$44,600.00
Percent extra cost of Byers Pipe over steel, based on replacement cost	4.6%

NOTE: It will be seen that if the pipe rusts out, the replacement cost will amount to even more than the total first cost of the entire system. The small initial saving of \$2,070.00 which might have been effected by using steel pipe in the above ten systems, must therefore be compared with the greatly increased liability to pipe failures.

Power Plant Piping System

*Pipe for Steam, Drips, Drains, Water, Oil, Compressed Air
and Plumbing*

Installation Cost

Pipe only (Byers).....	\$10,803.00
Valves.....	11,073.00
Fittings, Flanges, Bolts, Gaskets, Hangers and Supports.....	22,709.00
Pipe Covering.....	9,289.00
Freight.....	3,255.00
Shop Work and Erection Labor.....	39,249.00
Overhead, Contractor's Profit and Miscellaneous.....	18,142.00
Total, using Byers Pipe.....	\$114,520.00

Extra Cost of Byers Pipe

If steel pipe had been used the above piping system
would have cost \$109,658.00.

Difference in cost of pipe only (including overhead and contractor's profit).....	\$4,862.00
Percent "Saving" by using steel pipe.....	4.2%

Estimated Replacement Cost

Pipe system as above.....	\$114,520.00
100% extra labor.....	39,249.00
Damage to walls, floors, partitions and mechanical equipment.....	5,000.00
	\$158,769.00

Less Salvage:

30% on valves.....	\$3,322.00
30% on fittings, flanges, etc.....	6,813.00
	10,135.00

NET ESTIMATED REPLACEMENT COST.....	\$148,634.00
Percent extra cost of Byers Pipe over steel pipe, based on replacement cost.....	3.3%

SERVICE CONDITIONS

In a complete piping installation for a large power plant, the agencies which promote destruction of pipe, vary in steam, water and air lines; but, taken in its entirety, such a system suffers from practically every form of destruction to which pipe is subject. Condensation returning to boilers and heaters at high temperatures; aerated water from wells and cooling ponds; moisture deposited from compressed air; and drainage from plumbing fixtures, all are corrosive in high degree. Water hammer in many lines, and vibration from pumps, engines and mechanical equipment, tend to produce fatigue and crystallization in pipe walls—especially at points where threaded ends connect with solidly anchored fixtures.

Differences in temperature between periods of idleness and operation produce not only expansion and contraction, but many times leave pipe lines filled with corrosive vapor. Genuine wrought iron, of all pipe materials, has the maximum power to resist the action of these manifold agencies of destruction, whether they tend to corrode or crystallize the metal.

Power House Piping Complete

Steam and Water Piping in Water Works Power House

Installation Cost

Pipe only (Byers)	\$ 2,626.48
Valves, Fittings, Flanges, Hangers, Bolts, Gaskets	14,527.32
Shopwork, Erection and Supervision	4,508.80
Pipe Covering	2,500.00
Freight, Overhead, Profit and Miscellaneous	1,948.40
Total, using Byers Pipe	\$26,111.00

Extra Cost of Byers Pipe

If steel pipe had been used, the above system would have cost \$25,138.00.

Difference in cost of pipe only (including overhead and contractor's profit)	\$973.00
Percent "Saving" by using steel pipe	3.7%

Estimated Replacement Cost

First cost as above	\$26,111.00
100% extra labor	3,600.00
Damage to walls, floors and mechanical equipment	2,000.00
	\$31,711.00
<i>Less Salvage:</i>	
30% on valves, fittings, etc.	4,358.00
NET ESTIMATED REPLACEMENT COST	\$27,353.00
Percent extra cost of Byers Pipe over steel pipe, based on replacement cost	3.6%

NOTE: It will be seen that if the pipe rusts out, the replacement cost may amount to even more than the total first cost of the entire system. The small initial saving of \$973.00 which might have been effected by using steel pipe in the above system, must therefore be compared with the greatly increased liability to pipe failures. Such failures would eventually involve the owner in a replacement cost of \$27,353.00. In other words, 3.7% extra cost of Byers Pipe would be a small premium, paid but once, to insure the whole system against premature destruction. Probable stoppage of plant operation, or interruption of service during periods of repair and renewal are not taken into consideration in the above estimated replacement figures. The extra labor involved is estimated at a minimum, while salvage and damage items are placed at a reasonable average.

Service Conditions. Note remarks on page 14, applying to this general class of installation.

Argon Gas Plant

Complete Pipe Installation

Installation Cost

Pipe only (Byers)	\$ 5,897.50
Valves and Fittings	17,540.41
Flanges, Bolts and Gaskets, Hangers and Supports	9,891.47
Shop Work and Erection Labor	21,075.36
Pipe Covering	8,200.00
Freight, Hauling, Overhead, Profit and Miscellaneous	10,738.00
Total, using Byers Pipe	\$73,342.74

Extra Cost of Byers Pipe

If steel pipe had been used, the above system would have cost \$70,393.74.

Difference in cost of pipe only (including overhead and contractor's profit)	\$2,949.00
Percent "Saving" by using steel pipe	4.0%

Estimated Replacement Cost

Pipe system as above	\$73,342.74
100% extra labor	21,075.36
Damage to mechanical equipment, floors and containers	5,000.00
	\$99,418.10

Less Salvage:

30% on valves and fittings	\$5,262.00
30% on flanges, gaskets, etc.	2,967.00
	8,229.00

NET ESTIMATED REPLACEMENT COST	\$91,189.10
Percent extra cost of Byers Pipe over steel pipe, based on replacement cost	3.2%

This installation included gas piping only, which involved a great amount of complicated fitting work. This is one of the many cases in which Byers genuine wrought iron pipe is used chiefly because of its better welds and threads and lower shop cost.

Where the greatest strength and tightness of joints and welds are essential, as in gas and hydraulic installations, no pipe will give as permanently satisfactory results as Byers. This is due partly to the safer, stronger welds, characteristic of genuine wrought iron, and partly to its better threading qualities, resulting in tighter, safer and more permanent joints.

It will be noted that if the pipe rusts out, the replacement cost may amount to even more than the total first cost of the entire system. The small initial saving of \$2,949.00 which might have been effected by using steel pipe in the above system, must therefore be compared with the greatly increased liability to pipe failures. Such failures would eventually involve a replacement cost of \$91,189.00. In other words, 4.0% extra cost of Byers Pipe would be a small premium, paid but once, to insure the whole system against premature destruction.

Drinking Water System

For Blast Furnace and Rolling Mill

Installation Cost

Pipe only (Byers)	\$1,300.63
Valves and Fittings	619.62
Fountains	399.80
Cork Insulation	3,346.28
Labor	1,331.40
Overhead and Supervision	1,050.00
Total, using Byers Pipe	\$8,047.73

Extra Cost of Byers Pipe

If steel pipe had been used, the above system would have cost \$7,406.71.

Difference in cost of pipe only (including overhead and supervision)	\$641.02
Percent "Saving" by using steel pipe	7.9%

Estimated Replacement Cost

First cost, as above	\$8,047.73
100% extra labor and supervision	2,381.40
Damage to walls, partitions and mechanical equipment	1,000.00
	\$11,429.13

Less Salvage:

20% on valves and fittings	\$124.00
80% on fountains	320.00
	444.00

NET ESTIMATED REPLACEMENT COST	\$10,985.13
Percent extra cost of Byers Pipe over steel, based on replacement cost	5.8%

The cost of refrigeration and electrical equipment, pumps, filters, sterilizers, storage tanks and foundations, which amounted to \$11,484.00, is not included in any of the calculations shown.

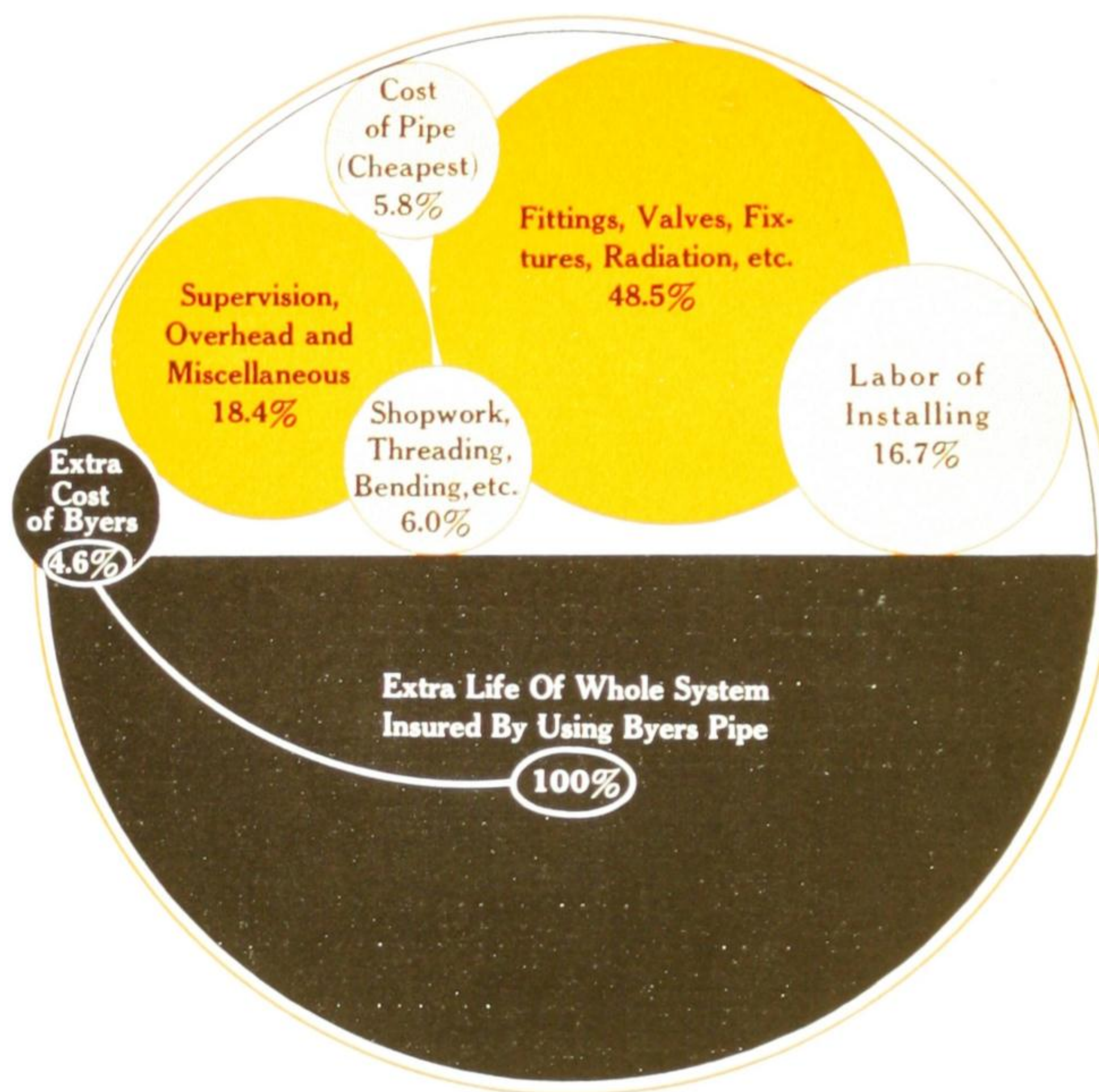
The important point to remember is that, if any part of the pipe fails, the salvage is very small and the replacement involves the use of new fittings and covering, and a considerable extra expense for labor of installing, shop labor, etc., all of which amount to ten or twenty times more than any initial saving made by using less durable pipe in the first installation. This holds good whether replacements are made intermittently, or the whole system is replaced at one time.

Due to the purity of the water, corrosion is a factor to be seriously reckoned with in almost any drinking water system, as has been amply demonstrated by past experience with such installations.

It will be noted that if the pipe rusts out, the replacement cost will amount to even more than the total first cost of the entire system. The small initial saving of \$641.02 which might have been effected by using steel pipe in the above system, must therefore be compared with the greatly increased liability to pipe failures. Such failures would eventually involve the owner in a replacement cost of \$10,985.13. In other words, the 7.9% extra cost of Byers Pipe would be the premium, paid but once, to insure the whole system against premature destruction. In the above estimated replacement figures, the extra labor involved is taken as a minimum, while salvage and damage items are placed at a reasonable average.

Extra Cost: 4.6%—Extra Life: 100%

Diagram Showing Relative Items of Cost in Average Pipe System



The diagram above shows graphically the relation between the cost of pipe and the other items of cost in a pipe system.

The life of the system is measured solely by the life of the pipe. Above all other materials that enter into the construction or equipment of home or factory, large or small, the pipe bears a burden of responsibility that cannot be shifted; for failure of the pipe carries with it failure and ruin of much more costly materials and equipment.

The home builder in particular is likely to look only at the extra cost of Byers Pipe, not realizing that on the life of the pipe depends the life of the whole plumbing or heating system. When the pipe corrodes away the entire installation is ready to be scrapped; floors, walls, ceilings and furnishings are damaged, often beyond repair; and the cost of replacing the pipe is greater than the entire first cost of installation. Even the failure of a single piece of inferior pipe may prove so costly as to wipe out the small amount which may, at first, be saved by using cheaper pipe.

The areas of the circles in the diagram represent the averages for all the estimates detailed in this bulletin. Note that the average extra cost of Byers Pipe is but 4.6%. Compare this with the greatly increased life it gives to all the systems, and there can be no doubt as to the folly of using less rust resisting pipe, either in residential or industrial pipe installations.

PART II

The Installation Cost of Plumbing and Heating Systems

In residences, apartments, office
buildings, schools, hospitals, and
miscellaneous other large and
small buildings.

Residential Pipe Systems

*Plumbing and Heating Systems in Four Different Residences
and Apartment Buildings*

Plumbing and Heating Installation Cost

1.	Single House, total cost of plumbing system, including fixtures, pipe, fittings, labor and miscellaneous.....	\$425.00	
	Pipe alone (Byers).....		\$40.04
2.	Two-family House, total cost of plumbing system.....	850.00	
	Pipe alone (Byers).....		83.50
3.	Two-family Apartment, total cost of plumbing system.....	2,000.00	
	Pipe alone (Byers).....		91.36
4.	Four-family Apartment, total cost of plumbing system.....	1,400.00	
	Total cost of heating system.....	1,550.00	
	Pipe alone (Byers).....		164.18
	Total cost of plumbing and heating systems in four buildings.....	\$6,225.00	
	Total cost of Byers Pipe in same.....		\$379.08

Extra Cost of Byers Pipe

If steel pipe had been used in the above plumbing and heating systems, the total cost would have been \$6,037.00.

Difference in cost of pipe only (including overhead and contractor's profit) \$188.00.

Average percent "Saving" if steel pipe had been used.....3.0%

In residential plumbing and heating systems the actual amount of money involved in the extra cost of Byers Pipe is extremely small—yet it insures owners and tenants years of trouble-free service and usually doubles life of the piping and accessories. Twenty to thirty dollars is the average extra cost for Byers Pipe over steel in the plumbing or heating of a single house, costing from \$7,000 to \$15,000. In a duplex or two-family house costing \$12,000 to \$25,000, the extra cost of Byers Pipe is forty to sixty dollars for plumbing or heating system.

It will be noted that if the pipe rusts out, the replacement cost will amount to even more than the total first cost of the entire system. The small initial saving of \$188.00 which might have been effected by using steel pipe in the four buildings shown above, must therefore be compared with the greatly increased liability to pipe failures. Such failures would eventually involve the owners in replacement costs that will average higher than the cost of the original installation. In other words, the 3.0% extra cost of Byers Pipe would be a small premium, paid but once, to insure the whole system against premature destruction. Probable loss of rent, or inconvenience to occupants during periods of repair and renewal, are not taken into consideration in the above. The extra labor involved is estimated at a minimum, while salvage and damage items are placed at a reasonable average.

And it is to be remembered that the *replacement* costs of residential systems, as in larger systems shown in detail on other pages of this bulletin, will almost invariably be *higher than the first cost* of such systems.

Hot Water Heating Contract

For Apartment Building

Installation Cost

Pipe only (Byers)	\$ 426.68
Boiler and Radiators	1,287.44
Valves, Fittings, and Thermometers	633.23
Sleeves, Hangers, Pipe Covering, Paint, Cartage	376.10
Labor	989.00
Overhead, Contractor's Profit and Miscellaneous	740.00
Total, using Byers Pipe	<u>\$4,452.45</u>

Extra Cost of Byers Pipe

If steel pipe had been used, the above heating system would have cost \$4,241.45.

Difference in cost of pipe only (including overhead and contractor's profit)	\$211.00
Percent "Saving" by using steel pipe	4.8%

Estimated Replacement Cost

Heating system as above	\$4,452.45
100% extra labor	989.00
Damage to walls, floors and fixtures	1,500.00
	<u>\$6,941.45</u>

Less Salvage:

80% on boilers and radiators	\$1,030.00
20% on valves and fittings	127.00
10% on sleeves and hangers	38.00
	<u>1,195.00</u>

NET ESTIMATED REPLACEMENT COST

\$5,746.45

Percent extra cost of Byers Pipe over steel pipe, based on replacement cost

3.7%

In apartments, office buildings, hotels, stores, residences, etc., extensive pipe replacements carry with them a very high incidental cost of repairing floors, walls and partitions, and a very high labor cost due to necessity of making repairs with the least possible damage to decorations and furnishings, and inconvenience and interference with the work of occupants. Due to the importance of these items, the extra cost of Byers Pipe should be measured against the estimated *replacement* cost rather than against the *first installation* cost.

It will be noted that if the pipe rusts out, the replacement cost may amount to even more than the total first cost of the entire system. The small initial saving of \$211.00 which might have been effected by using steel pipe in the above system, must therefore be compared with the greatly increased liability to pipe failures. Such failures would eventually involve the owner in a replacement cost of \$5,746.45. In other words, 4.8% extra cost of Byers Pipe would be a small premium, paid but once, to insure the whole system against premature destruction. Probable loss of rent, or inconvenience to tenants during periods of repair and renewal are not taken into consideration in the above estimated replacement figures. The extra labor involved is estimated at a minimum, while salvage and damage items are placed at a reasonable average.

Plumbing Contract

For a Bank Building in a Small Town

Installation Cost

Pipe only (Byers)	\$ 328.41
Fittings, Valves and Soil Pipe	438.44
Fixtures	1,204.70
Hangers, Cartage, Carfares and Permits	331.26
Labor	1,200.00
Overhead, Contractor's Profit and Miscellaneous	702.19
Total, using Byers Pipe	\$4,205.00

Extra Cost of Byers Pipe

If steel pipe had been used, the above plumbing system would have cost \$4,059.00.

Difference in cost of pipe only (including overhead and contractor's profit)	\$146.00
Percent "Saving" if steel pipe had been used	3.5%

Estimated Replacement Cost

Plumbing system as above	\$4,205.00
100% extra labor	1,200.00
Damage to walls, floors and fixtures	500.00
	\$5,905.00

Less Salvage:

30% on valves, fittings and soil pipe	\$131.00
80% on fixtures	964.00
10% on hangers, etc.	33.00
	1,128.00

NET ESTIMATED REPLACEMENT COST

\$4,777.00

Percent extra cost of Byers Pipe over steel pipe, based on replacement cost

3.0%

NOTE: It will be noted that if the pipe rusts out, the replacement cost will amount to even more than the total first cost of the entire system. The small initial saving of \$146.00, which might have been effected by using steel pipe in the above system, must therefore be compared with the greatly increased liability to pipe failures. Such failures would eventually involve the owner in a replacement cost of \$4,777.00. In other words, the 3.5% extra cost of Byers Pipe would be a small premium, paid but once, to insure the whole system against premature destruction. Probable loss of rent, or inconvenience to occupants during periods of repair and renewal are not taken into consideration in the above estimated replacement figures. The extra labor involved is estimated at a minimum, while salvage and damage items are placed at a reasonable average.

More detailed information in regard to corrosive conditions in plumbing systems is contained in Byers Bulletin No. 30, presenting the results of an investigation of pipe corrosion in 129 apartment buildings, and in Bulletin No. 32 containing the reports on two separate investigations of the corrosion of iron and steel pipe in house drainage systems. These investigations were made in New York, Chicago and Pittsburgh. Copies will be mailed on request.

In all of these investigations, wrought iron pipe was shown to resist corrosion very much better than steel, lasting two or three times longer, and for all practical purposes being as good as brass pipe.

Vapor Heating System

For Bank Building in Small Town

Installation Cost

Pipe only (Byers)	\$ 425.00
Boiler and Radiators	1,341.25
Valves, Fittings, and Accessories	525.30
Sleeves, Hangers, Floor Plates, Pipe Covering	438.45
Labor	1,100.00
Overhead, Contractor's Profit and Miscellaneous	770.00
Total, using Byers Pipe	\$4,600.00

Extra Cost of Byers Pipe

If steel pipe had been used, the above heating system would have cost \$4,390.00.

Difference in cost of pipe only (including overhead and contractor's profit)	\$210.00
Percent "Saving" if steel pipe had been used	4.6%

Estimated Replacement Cost

Heating system as above	\$4,600.00
100% extra labor	1,100.00
Damage to walls, floors and fixtures	250.00
	<u>\$5,950.00</u>

Less Salvage:

20% on valves and fittings	\$ 105.00
80% on boiler and radiators	1,073.00
10% on sleeves, hangers, etc.	44.00
	<u>1,222.00</u>

NET ESTIMATED REPLACEMENT COST

	\$4,728.00
Percent extra cost of Byers Pipe over steel pipe, based on replacement cost	4.4%

NOTE: It will be seen that if the pipe rusts out, the replacement cost may amount to even more than the total first cost of the entire system. The small initial saving of \$210.00, which might have been effected by using steel pipe in the above system, must therefore be compared with the greatly increased liability to pipe failures. Such failures would eventually involve the owner in a replacement cost of \$4,728.00. In other words, 4.6% extra cost of Byers Pipe would be a small premium, paid but once, to insure the whole system against premature destruction. Probable loss of rent, or inconvenience to occupants during periods of repair and renewal are not taken into consideration in the above estimated replacement figures. The extra labor involved is estimated at a minimum, while salvage and damage items are placed at a reasonable average.

The heating system is frequently the cause of considerable expense in buildings after five or ten years' occupancy. Both hot water and water of condensation, cause aggravated corrosion, and a large number of leaks frequently occur at the beginning of each winter season if inferior pipe is used.

No matter how well the system might have been designed, repairs of these leaks, even though they may involve but small sections of pipe or perhaps only nipples, result in outlay and inconvenience that completely overshadow the first cost of the failed material. It is advisable, *always*, to see that not only Byers Pipe, but also Byers Nipples are used in permanent installations.

Byers Nipples are plainly stamped with the Byers name and can readily be identified by contractor or owner.

Plumbing System

For Residence Costing \$250,000.00

Installation Cost

Pipe only (Byers)	\$ 702.39
Valves, Fittings and Soil Pipe	1,072.49
Fixtures	6,156.33
Pipe Covering	387.00
Special Items	345.24
Labor	3,284.00
Overhead, Contractor's Profit and Miscellaneous	2,402.55
Total, using Byers Pipe	\$14,350.00

Extra Cost of Byers Pipe

If steel pipe had been used, the above plumbing system would have cost \$13,978.00.

Difference in cost of pipe only (including overhead and contractor's profit)	\$372.00
Percent "Saving" if steel pipe had been used	2.7%

Estimated Replacement Cost

Plumbing system as above	\$14,350.00
100% extra labor	3,284.00
Damage to walls, floors and fixtures	5,000.00
	\$22,634.00

Less Salvage:

30% on valves, fittings and soil pipe	\$ 322.00
80% on fixtures	4,925.00
50% on special items	173.00
	5,420.00

NET ESTIMATED REPLACEMENT COST	\$17,214.00
Percent extra cost of Byers Pipe over steel pipe, based on replacement cost	2.2%

NOTE: It will be seen that if the pipe rusts out, the replacement cost may amount to even more than the total first cost of the entire system. The small initial saving of \$372.00, which might have been effected by using steel pipe in the above system, must therefore be compared with the greatly increased liability to pipe failures. Such failures would eventually involve the owner in a replacement cost of \$17,214.00. In other words, the 2.7% extra cost of Byers Pipe would be a small premium, paid but once, to insure the whole system against premature destruction. Probable inconvenience to occupants during periods of repair and renewal is not taken into consideration in the above estimated replacement figures. The extra labor involved is estimated at a minimum, while damage items are conservatively figured when it is remembered that in this residence the fixtures are of the highest quality and a large part of the piping is concealed in walls and floors.

Heating Contract

For Residence on Opposite Page

Installation Cost

Pipe only (Byers)	\$ 637.20
Gas and Coal Boilers, Radiators and Sheet Metal Work	5,245.10
Valves and Fittings	1,291.26
Heat Insulating Material	481.00
Pressure Guages, Heat Regulator, Special Items	281.44
Labor	2,064.00
Overhead, Supervision, Profit, Temporary Heat	2,000.00
Total, using Byers Pipe	\$12,000.00

Extra Cost of Byers Pipe

If steel pipe had been used, the above system would have cost \$11,650.00.

Difference in cost of pipe only (including overhead and contractor's profit)	\$350.00
Percent "Saving" if steel pipe had been used	3.0%

Estimated Replacement Cost

System as above	\$12,000.00
100% extra labor	2,064.00
Damage to walls, floors and fixtures	2,500.00
	\$16,564.00

Less Salvage:

80% on boilers and radiation	\$4,196.00
20% on valves and fittings	258.00
50% on special items	141.00
	4,595.00

NET ESTIMATED REPLACEMENT COST	\$11,969.00
Percent extra cost of Byers Pipe over steel pipe, based on replacement cost	3.0%

NOTE: It will be seen that if the pipe rusts out, the replacement cost may equal the total first cost of the entire system. The small initial saving of \$350.00, which might have been effected by using steel pipe in the above system, must therefore be compared with the greatly increased liability to pipe failures. Such failures would eventually involve the owner in a replacement cost practically identical with the first cost of the whole system. In other words, 3.0% extra cost of Byers Pipe would be a small premium, paid but once, to insure at least double life in an installation of this character. Probable inconvenience to occupants during periods of repair and renewal is not taken into consideration in the above estimated replacement figures. The extra labor involved is estimated at a minimum, while salvage and damage items are placed at a reasonable average.

Plumbing System

For Addition to High School Building

Installation Cost

Pipe only (Byers)	\$2,025.03
Valves, Fittings and Nipples	828.69
Fixtures	3,413.23
Pipe Covering	935.00
Hangers, Soil Pipe and Special Items	2,648.19
Labor	8,880.12
Overhead, Contractor's Profit and Miscellaneous	3,744.74
Total, using Byers Pipe	\$22,475.00

Extra Cost of Byers Pipe

If steel pipe had been used, this plumbing system would have cost \$21,578.22.

Difference in cost of pipe only (including overhead and contractor's profit)	\$896.78
Percent "Saving" by using steel pipe	4.0%

Estimated Replacement Cost

Plumbing system as above	\$22,475.00
100% extra labor	8,880.12
Damage to floors, walls and fixtures	1,000.00
	\$32,355.12

Less Salvage:

20% on valves and fittings	\$ 165.70
80% on fixtures	2,730.58
50% on hangers and special items	1,324.10
	4,220.38

NET ESTIMATED REPLACEMENT COST	\$28,134.74
Percent extra cost of Byers Pipe as compared with steel pipe, based on replacement cost	3.2%

NOTE: It will be seen that if the pipe rusts out, the replacement cost will amount to considerably more than the total first cost of the entire system. The small initial saving of \$896.78, which might have been effected by using steel pipe in the above system, must therefore be compared with the greatly increased liability to pipe failures. Such failures would eventually involve a replacement cost of \$28,134.74. In other words, the 4.0% extra cost of Byers Pipe would be a small premium, paid but once, to insure the whole system against premature destruction. Probable inconvenience to occupants and loss of teaching time, during periods of repair and renewal, are not taken into consideration in the above estimated replacement figures. The extra labor involved is estimated at a minimum, while salvage and damage items are placed at a reasonable average.

One may conservatively expect Byers Pipe to give 100 percent longer life than the best steel pipe in a system similar to the above.

Steam Heating System

For Apartment Building

Installation Cost

Pipe alone (Byers)	\$1,800.00
Boilers, Radiators and Mechanical Equipment	8,455.00
Valves, Fittings and Accessories	2,745.00
Heat Insulating Material	1,250.00
Special Items	731.00
Labor	6,480.00
Overhead, Profit, Temporary Heat and Miscellaneous	4,967.00
Total, using Byers Pipe	\$26,428.00

Extra Cost of Byers Pipe

If steel pipe had been used, the above installation would have cost \$25,508.00.

Difference in cost of pipe only (including overhead and contractor's profit)	\$920.00
Percent "Saving" by using steel pipe	3.5%

Estimated Replacement Cost

System as above	\$26,428.00
100% extra labor	6,480.00
Damage to walls, floors and fixtures	2,000.00
	<u>\$34,908.00</u>

Less Salvage:

80% boilers and radiation	\$6,764.00
20% valves and fittings	549.00
50% special items	366.00
	<u>7,679.00</u>

NET ESTIMATED REPLACEMENT COST	\$27,229.00
Percent extra cost of Byers Pipe over steel pipe, based on replacement cost	3.4%

When the heating pipes in a system begin to fail, the owner either faces continuous emergency repairs with attendant heavy gradual depreciation of the property value, or complete remodeling of the piping, involving a heavy repair expense to the building. The latter alternative, although more drastic, is probably the least expensive, for few things make a building suffer more in appearance and reputation than frequent and ever-increasing pipe failures.

What has just been said is particularly true of apartments and office buildings, occupied by a large number of people with whom the appearance of their quarters counts heavily for or against paying the rental asked. With such issues at stake, the extra few hundred dollars paid to obtain the best kind of pipe, are like the proverbial stitch in time.

It will be noted that if the pipe rusts out, the replacement cost will amount to even more than the total first cost of the entire system. The small initial saving of \$920.00, which might have been effected by using steel pipe in the above system, must therefore be compared with the greatly increased liability to pipe failures. Such failures would eventually involve the owner in a replacement cost of \$27,229.00. In other words, the 3.5% extra cost of Byers Pipe would be a small premium, paid but once, to insure the whole system against premature destruction.

Plumbing System

For a Modern Hospital

Installation Cost

Pipe only (Byers)	\$19,586.00
Valves and Fittings	17,000.00
Fixtures	37,000.00
Pipe Covering	11,000.00
Pumps, Filters and Soil Pipe	29,000.00
Labor	37,000.00
Overhead, Contractor's Profit and Miscellaneous	22,589.00
Total, using Byers pipe	\$173,175.00

Extra Cost of Byers Pipe

If steel pipe had been used, the above plumbing system would have cost \$164,150.00.

Difference in cost of pipe only (including overhead and contractor's profit)	\$9,025.00
Percent "Saving" by using steel pipe	5.2%

Estimated Replacement Cost

Plumbing system as above	\$173,175.00
100% extra labor	37,000.00
Damage to floors, walls and fixtures	10,000.00
	\$220,175.00

Less Salvage:

20% on valves and fittings	\$ 3,400.00
80% on fixtures	29,600.00
80% on pumps and filters	23,200.00
	56,200.00

NET ESTIMATED REPLACEMENT COST	\$163,975.00
Percent extra cost of Byers Pipe over steel pipe, based on replacement cost	5.5%

NOTE: It will be seen that if the pipe rusts out, the replacement cost will approximate the total first cost of the entire system. The small initial saving of \$9,025.00, which might have been effected by using steel pipe in the above system, must therefore be compared with the greatly increased liability to pipe failures. Such failures would eventually involve replacement costs of \$163,975.00. In other words, 5.2% extra cost of Byers Pipe would be a small premium, paid but once, to insure the whole system against premature destruction. Probable inconvenience and even danger to patients during periods of repair and renewal, are not taken into consideration in the above estimated replacement figures. The extra labor involved is estimated at a minimum, while salvage and damage items are placed at a reasonable average.

In office buildings, hotels, stores, apartments, and particularly in hospitals, pipe replacements carry with them a very high incidental cost of repairing damage to floors, walls, and partitions, and a very high labor cost due to necessity of making repairs with the least possible inconvenience to occupants.

Steam Heating System

For Hospital on Opposite Page

Installation Cost

Pipe alone (Byers)	\$ 6,120.00
Boilers, Radiators, Sheet Metal and Mechanical Equipment	49,261.00
Valves, Fittings, Flanges, Gaskets, Accessories	14,122.00
Heat Insulating Material	12,000.00
Special Items	3,800.00
Labor	23,000.00
Overhead, Supervision, Profit and Miscellaneous	10,830.00
Total, using Byers Pipe	\$119,133.00

Extra Cost of Byers Pipe

If steel pipe had been used, the above system would have cost \$116,141.00.

Difference in cost of pipe only (including overhead and contractor's profit)	\$2,992.00
Percent "Saving" if steel pipe had been used	2.6%

Estimated Replacement Cost

System as above	\$119,133.00
100% extra labor	23,000.00
Damage to walls, floors, and fixtures	25,000.00
	\$167,133.00

Less Salvage:

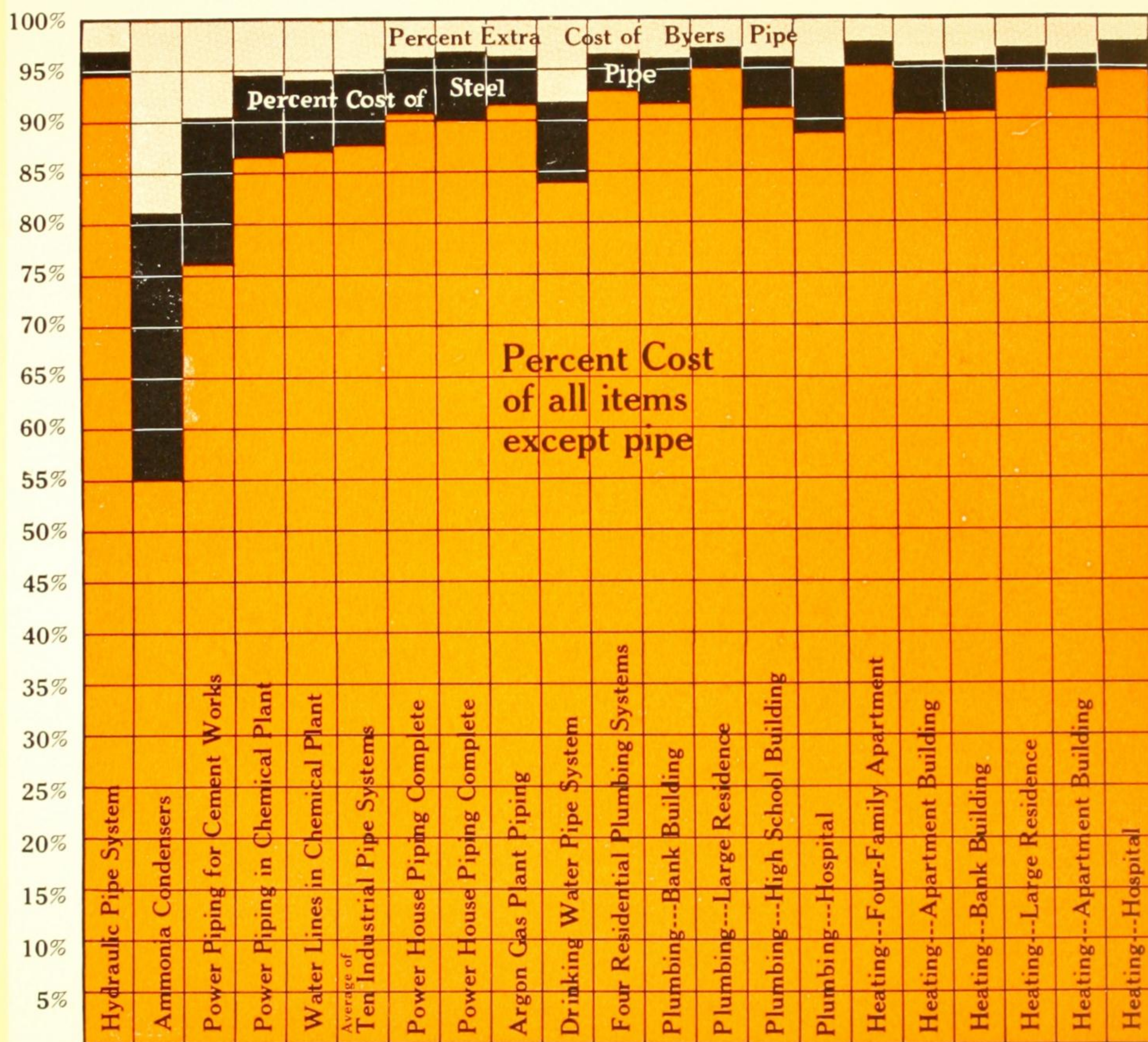
80% on boilers and radiators	\$39,408.00
20% on valves and fittings	2,824.00
50% on special items	1,900.00
	44,132.00

NET ESTIMATED REPLACEMENT COST	\$123,001.00
Percent extra cost of Byers Pipe over steel pipe, based on replacement cost	2.4%

NOTE: It will be seen that if the pipe rusts out, the replacement cost will amount to even more than the total first cost of the entire system. The small initial saving of \$2,992.00, which might have been effected by using steel pipe in the above system, must therefore be compared with the greatly increased liability to pipe failures. Such failures would eventually involve a replacement cost of \$123,000.00. In other words, the 2.6% extra cost of Byers Pipe would be a small premium, paid but once, to insure the whole system against premature destruction. Probable inconvenience to patients and personnel during periods of repair and renewal is not taken into consideration in the above estimated replacement figures. The extra labor involved is estimated at a minimum, while salvage and damage items are placed at a reasonable average.

It is sometimes argued that corrosion should be very small in a heating system. The corrosion will vary considerably with the installation and practice; but, as experience has fully demonstrated, there is ample access of oxygen and other gases in the make-up water and in seasonal refilling, to result in rapid deterioration in many parts of a steel pipe system.

Percent Diagram showing Extra Cost of Byers Pipe and Relation of Pipe Cost to Installation Cost in 33 Pipe Systems



Explanation

- Red represents total installation cost, minus pipe cost
- Black represents cost of steel pipe alone
- Pink represents extra cost of Byers pipe

THE figures contained in the cost analyses of the 33 different pipe systems, (pages 8 to 29) in the above diagram have been reduced to a percentage basis, for the purpose of illustrating how large the cost of *installing* pipe usually is, and how *small* the extra cost of Byers Pipe, yet insuring on an average double the life in service from the *whole* pipe system.

Other Byers Publications

Copies Sent on Request

Bulletin No. 26-A—What is Wrought Iron?

Explains the physical and chemical differences between soft steel and wrought iron as made for pipe manufacture. It also contains a résumé of evidence on the corrosion resistance of wrought iron brought out by numerous investigations. Closing pages give list prices, weights, dimensions and areas of Byers Pipe, couplings and nipples.

Bulletin No. 30—An Investigation of Pipe Corrosion.

Showing service records of iron, steel and brass pipe used for hot and cold water supply lines in 129 Pittsburgh apartment buildings. A report of general interest to architects, engineers and builders, not only in Pittsburgh where the investigation took place, but in most other cities where the domestic water supply is of similar character. Analyses of tap water in Pittsburgh and a number of other cities are given for the guidance of those who wish to make a comparison with the water in their own localities.

Bulletin No. 32—Corrosion of Wrought Iron, Cast Iron and Steel Pipe in House Drainage Systems.

Data obtained through investigations conducted in New York and Chicago by Dr. Wm. Paul Gerhard, C. E., Consulting Sanitary Engineer, and Thomas J. Claffy, formerly Assistant Chief Sanitary Inspector, City of Chicago. Both reports contain condensed records of tests on over 800 pipes in 144 buildings located in the business section of the two cities mentioned. The great difference in the corrosion of wrought iron and steel pipe installations is strikingly shown by actual photographs.

Bulletin No. 34—The Life of Pipe in Refrigeration Service.

Contains information about the respective advantages of wrought iron and steel pipe for high and low pressure piping, including coils, in refrigeration systems. Investigations showed the average life of ammonia condensers to be nineteen years if made of wrought iron pipe, and eight years if made of steel pipe. A number of interesting cases are cited, showing the great economy of using wrought iron pipe for this purpose.

Bulletin No. 41—Some Facts about Galvanized and Other Coated Pipe.

Explains why galvanized pipe is usually cheaper in the long run than black pipe; shows the advantages of black iron over galvanized steel pipe; discusses the factors that influence the thickness of the coating, its penetration and its adhesion to the base metal.

Report by an Investigating Committee of Architects and Engineers

on Wrought Iron Pipe as manufactured by A. M. Byers Co. This committee represents about twelve hundred of the better architects and engineers of the country, affiliated for the purpose of securing reliable information on any subject of interest to an architect or engineer in connection with the construction and equipment of a building.

Booklet—On the Trail of Byers Pipe.

An illustrated record of the service given by Byers pipe in plumbing, heating, and power systems in the largest and best known buildings in America erected from 25 to 40 years ago. A brief record of the service given by the pipe in each building is shown in connection with the photographs thereof.

How to Tell the Difference Between Iron and Steel Pipe

There are about eight different ways to determine whether pipe is iron or steel. The four easiest ways are explained below. Tests 1, 2 and 3 can be applied to either new or old pipe. Identification by name rolled in the pipe is applicable only to pipe made within the last 15 or 16 years. More detailed information on this subject will be found in Bulletin No. 41, which will be sent on request.

1. FRACTURE TEST

The fracture of genuine wrought iron pipe appears *ragged, dull gray and fibrous*. The fibre is particularly distinct when



Iron Fracture—Dull, Gray and Fibrous

compared with a steel fracture. A fracture is easily obtained by hammering a short piece of pipe, as shown in the illustration at the right under "Galvanizing Test."

The fracture of steel is *even, bright and crystalline*, which, when exposed to the air soon loses its luster. Moreover, steel pipe shows a tendency to fracture at the weld, and

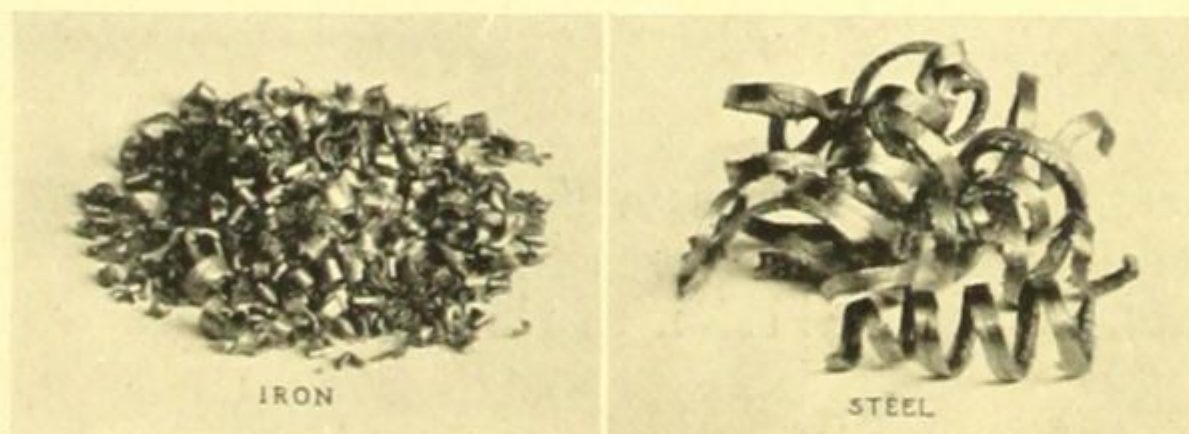


Steel Fracture—Even, Bright and Crystalline

here the metal presents a smooth, dull gray appearance, which should not be confused with the tough, fibrous fracture of wrought iron.

2. THREADING TEST

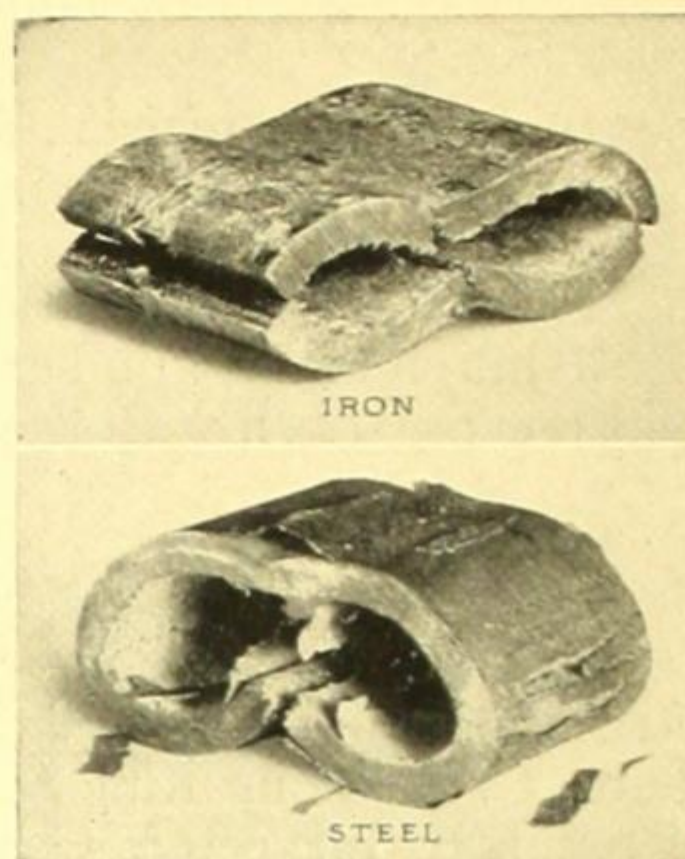
When wrought iron pipe is threaded, its fibrous structure causes the chip to *break and crumble* as when dressing the end of a piece of wood. (This prevents clogging of the die space and reduces friction. A clean, accurate thread results.)



With steel, owing to the absence of fibre, the chip tends to curl up, forming a *long, more or less perfect spiral*, beautiful to look at but an obstacle to easy threading, for it increases friction and causes clogging of the chip space.

3. GALVANIZING TEST

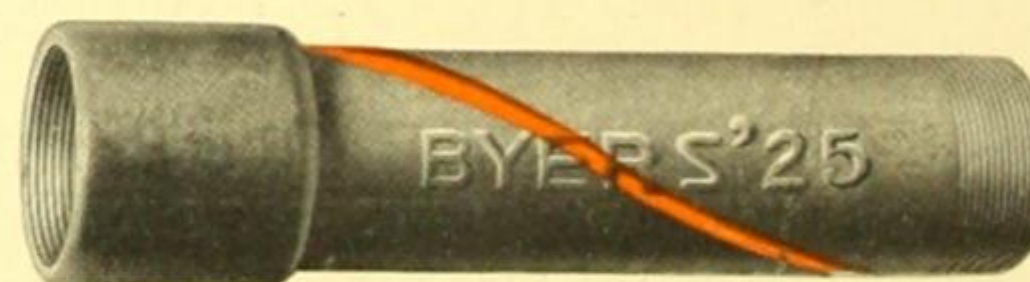
Hammer a piece of galvanized pipe repeatedly to flatten it. If the zinc coating adheres firmly to the pipe, showing little effect of the hammering or flattening, it is wrought iron pipe. If, on the other hand, the zinc begins to scale off at almost the first stroke of the hammer, the pipe is steel. Repeated blows will cause the galvanizing to come off in large flakes, leaving the steel almost bare in spots. This is virtually what happens during handling, cutting, bending and threading steel pipe, and in the course of years of service.



Hammer a piece of Byers Pipe and note the tenacious hold of the coating on the iron. You may fracture the pipe, and the galvanizing will fracture with it, without cracking and scaling off at the edge of the fracture.

4. IDENTIFYING MARKS

Byers pipe is easily identified by the Spiral Stripe painted on each length in red or other bright color. The spiral marking effectively prevents mistakes and substitution. In addition,



THE SPIRAL STRIPE protects you against mistakes and substitution; also look for NAME and YEAR rolled in metal.

the Byers Name and two figures indicating Year of Manufacture are rolled in the Metal at intervals of three or four feet, as shown in cut above.

A. M. BYERS COMPANY, Pittsburgh, Pa.

ESTABLISHED 1864

New York
Cincinnati

Philadelphia
Rochester

Boston
St. Louis

Chicago
Tulsa

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Cleveland
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